

## Administration of Methohexital for Pediatric Outpatient Dentistry

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Rectally administered methohexital is a safe, effective sedative to ameliorate the stress of the surgical experience for the uncooperative child. The rapid onset, relatively short duration, and patient acceptance of this technique make it applicable for many pediatric outpatient procedures. Induction doses of 20–30 mg/kg of a 10% methohexital solution can produce sleep in 7–8 minutes. In some situations, the rectal route of administration has advantages over more commonly used techniques.

The induction of general anesthesia in the pediatric patient has long been recognized as being a traumatic experience for the child, parent, anesthetist and dentist. As early as 1953, Migdal recognized that “the psychic trauma in children associated with the administration of an anesthetic cannot be overemphasized”.<sup>1</sup> Although the psychological impact appears to vary with the developmental stage, toddlers and preschool children tend to be at particular risk.<sup>2</sup> Child psychiatrists have identified this period, from the ages of one to five, as one associated with significant “separation anxiety”, a very close identification with his/her parents and tremendous fear of facing the unknown without their presence.<sup>3</sup> A variety of studies have documented that childhood illness, hospitalization and surgery occurring during this period can cause psychological trauma which may manifest itself in regression, depression or enuresis.<sup>4,5,6</sup> Data suggest that

a stormy anesthetic induction may cause psychological harm to the child.<sup>7,8</sup>

Preoperative sedatives including benzodiazepines, barbiturates and narcotics, may be given to healthy children solely to blunt awareness, thereby decreasing the psychological upset resulting from the consequences of parental separation and anesthetic induction. Oral, sublingual, inhalational, intramuscular (IM), intravenous (IV) and nasal routes have all been advocated for administration of these medications to sedate children or even induce anesthesia. Each route has its potential negative aspects.

The inhalational method involves agents which have an unpleasant smell and requires the use of a mask, which many children find objectionable, often struggling against application of the mask. Even if the child accepts the mask, as he passes into Stage II of general anesthesia it often becomes necessary to restrain the child as he becomes disinhibited during loss of consciousness. Some pediatric anesthesiologists encourage parental presence during inhalation inductions to allay anxiety of both parent and child.<sup>9</sup> When this technique is used, the parents must be aware of the possibility of possible struggling during stage II, despite the likelihood of amnesia and altered consciousness. Reassurance, distraction of the patient, and flavoring the inspired gas flow may help to facilitate a smooth induction in the child mature enough to cooperate.

The intravenous administration of anesthetic agents is frequently pleasant and quick in the cooperative patient, eliminating the use of the face mask and minimizing pollution in the operating area. The major disadvantage of this route is the difficulty often encountered in placing an indwelling venous catheter in an uncooperative child.

In the uncooperative child an intramuscular injection of a sedative agent can have the advantage of delaying separation of the child from the parent until sedation has been achieved. In addition, the child is usually familiar with injection from prior primary pediatric care. Nevertheless, it is still painful and distressing. Ketamine, in particular, has been associated with hallucinations and delirium,

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even in small children.<sup>10</sup> Some parents find the characteristic horizontal nystagmus quite distressing, and should be informed of this possibility prior to ketamine administration.<sup>11</sup> Nasal and sublingual routes of premedication in children are currently being evaluated, but ethical objections related to the potential recreational use of these routes have been voiced by some against these modes of drug delivery.<sup>12,13</sup> The onset of the oral premedications may be long and unpredictable.

The rectal administration of methohexital (Brevital) for pediatric anesthesia to facilitate the induction of anesthesia has been widely reported in the anesthesia literature,<sup>14–16</sup> but it has not become routine for pediatric outpatient dental care. This technique is widespread for children during many diagnostic radiological procedures as well as an induction technique for both in and outpatients. With this technique, a smooth atraumatic induction of a light level of anesthesia may be easily accomplished. The small child who is frightened of needles and the anesthetic mask will often accept the rectal catheter due to his familiarity with having his temperature measured in this manner.

The rectal administration of methohexital rapidly eliminates separation anxiety for both the parents and the child without painful injection. The anesthetic may be administered while the parents hold the child, and the child will often fall asleep before being transported to the operating room.

Although a variety of concentrations of methohexital have been used,<sup>15,18</sup> our recommendation is that methohexital for rectal administration be prepared by dissolving 500 mg methohexital sodium (Brevital) crystals in 5 ml sterile water to make a 10 percent solution. This solution is drawn up into a 5 ml syringe, and the end of a rubber catheter cut to a length of two to three inches and attached to the syringe. The child is told that his temperature will be taken, and that he will become sleepy after this, and that while he is fast asleep his dental work will be completed. The child is placed on his side with the buttocks exposed and the well lubricated catheter is inserted approximately two inches into the rectum. Two to three ml of solution (20–30 mg/kg methohexital) is instilled, and the catheter may then be cleared with air to ensure that the total dose was given. The initial dose should not exceed 500 mg regardless of the child's weight.

The child may be allowed to stay with the parents until the lid reflex is lost, but it is essential that the patient not be left unattended, and should be transported to the operating room expeditiously with supplemental oxygen readily available. As with any anesthetic technique, respiratory depression may be encountered. Voss et al. have reported on oxygen saturation following administration of rectal methohexital.<sup>19</sup> Although some desaturation can occur in the holding area prior to transport, it is self-remitting. Desaturation more commonly occurs after sleep

following transport to the operating room. Premature stimulation of the child before hypnosis has ensued may precipitate hiccoughs.

In the past, the recommended dose of rectal methohexital has ranged from 15–30 mg/kg. In a study of 99 pediatric patients, Liu et al. found that the increase in the number of children who fell asleep when the dose was increased from 20 to 30 mg/kg was not statistically significant. Using 20 mg/kg, the mean sleep induction time was  $7.8 \pm 2.2$  minutes.<sup>16</sup> The use of a 1% solution of methohexital reduced the mean administration-sleep time to less than 6 minutes, but did prolong recovery significantly in cases longer than 1 hour.<sup>17</sup>

Liu et al. subsequently reported that a patient is likely to fall asleep when the peak plasma methohexital concentration exceeds  $2 \mu\text{g/ml}$ .<sup>20</sup> Several factors may keep the blood level from reaching this level. Solutions deposited in the lower third of the rectum are absorbed directly into the systemic circulation via the upper part of the rectum via the middle and superior hemorrhoidal venous plexus, they are transported to the portal system venous system and thus pass through the liver where first-pass hepatic metabolism decreases the systemic bio-availability (hepatic extraction ratio of 0.5). A complicating factor is that there is no precise anatomical division between the veins draining to the portal and those draining to the systemic circulation, because of the presence of anastomoses.<sup>21</sup>

The rectal distribution and absorption of rectally administered methohexital may be mechanically impeded by the presence of feces or mucous in the rectum as well as well as absorbed into the feces preventing uptake. A variable incidence of defecation following the rectal administration of methohexital has been reported ranging from 5–15%.<sup>16,20,22</sup>

The duration of sleep which is achieved with the rectal administration of a 20–30 mg/kg dose of methohexital falls well within the range of most outpatient procedures. In a study using 22 mg/kg of methohexital, awakening occurred in 20–30 minutes.<sup>15</sup> Increasing the dose to 30 mg/kg caused patients to sleep at least 25 minutes, with half sleeping at least one hour.<sup>23</sup>

In a study by Goresky and Steward comparing the induction of anesthesia using methohexital administered rectally in a dose of 25 mg/kg to intravenous sodium thiopental (5 mg/kg) there was no difference in postoperative recovery and the incidence of nausea and vomiting was the same with both techniques.<sup>15</sup>

There has been some controversy concerning the irritating effect of methohexital on the rectal mucosa. Hinkle and Weinlander have reported the use of a mouse rectal pouch to document epithelial sloughing, mucosal ulceration, and inflammation 60 minutes following exposure to 10% methohexital. This mucosal irritating quality of methohexital could not be recreated by solutions that

were alkaline or hyperosmolar suggesting that the mucosal lesions were a direct result of the drug itself.<sup>24,25</sup> Thus far, these mucosal lesions have not been documented in humans. Budd, et al. performed proctoscopic examinations on patients 24 hours following the rectal administration of 10% Methohexital. No pathologic changes of the rectal mucosa were noted.<sup>22</sup>

The other potential complications associated with the rectal administration of methohexital are similar to those associated with its intravenous administration. Allergic reactions and seizure activity are rare but have occurred following the rectal administration of methohexital.<sup>26,27</sup> Although methohexital is not specifically contraindicated for epileptic patients, alternative sedative techniques may be more appropriate.

As with all anesthetic techniques, proper attention to the patient's airway and cardiopulmonary status is essential following the rectal administration of methohexital.<sup>28</sup> The patient should not have anything to eat or drink for at least 6 hours prior to the procedure and adequate monitoring equipment must be available (i.e. blood pressure monitoring, electrocardiogram, pulse oximeter, and precordial stethoscope) and applied once the patient is transported to the operating suite. Those administering this medication must be skilled in the management of the pediatric airway. The patient must be continuously monitored from the initial administration of the medication. When adequate sedation has been achieved, an intravenous line may be established in order to supplement the rectal methohexital with an intravenous sedative or other anesthetic agents to achieve the necessary level of sedation or anesthesia, and to provide emergency access for management of possible complications.

The rectal induction of anesthesia using 10% methohexital is a safe, reliable, and effective technique when it is administered following the above guidelines. It is especially suited to the uncooperative child aged 1 to 5 years, when separation anxiety appears most pronounced. Psychological trauma to the child is minimized, thus decreasing the child's apprehension at future visits to the dental office as well as minimizing parental distress. The rectal administration of methohexital is a useful technique for dentists trained in general anesthesia for providing a safe, pleasant, and rapid method of heavily sedating the pediatric patient.

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